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Methicillin-resistant *Staphylococcus aureus* (MRSA):

101 & Beyond

04/20/2012

MRSA/CDI Prevention Initiative Kick Off

Russ Olmsted – Director, Infection Prevention & Control Services

REMARKABLE MEDICINE. REMARKABLE CARE.

Session Objectives

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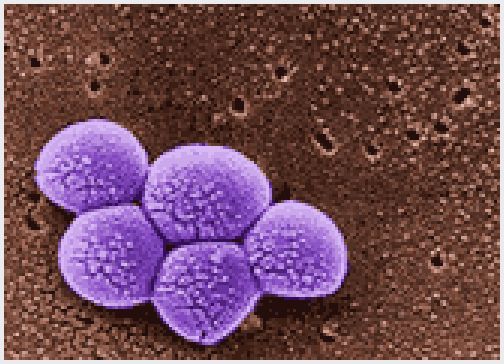
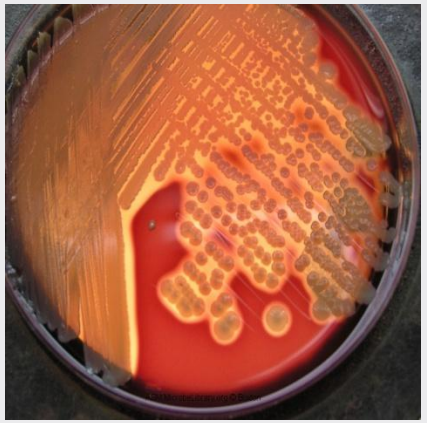
- Describe the epidemiology of methicillin-resistant *Staphylococcus aureus* (MRSA) in the U.S. and Michigan
- Understand how progress with prevention of MRSA across the U.S. relates to healthcare facilities in Michigan
- List at least one strategy to prevent cross transmission within and between healthcare facilities

Identification

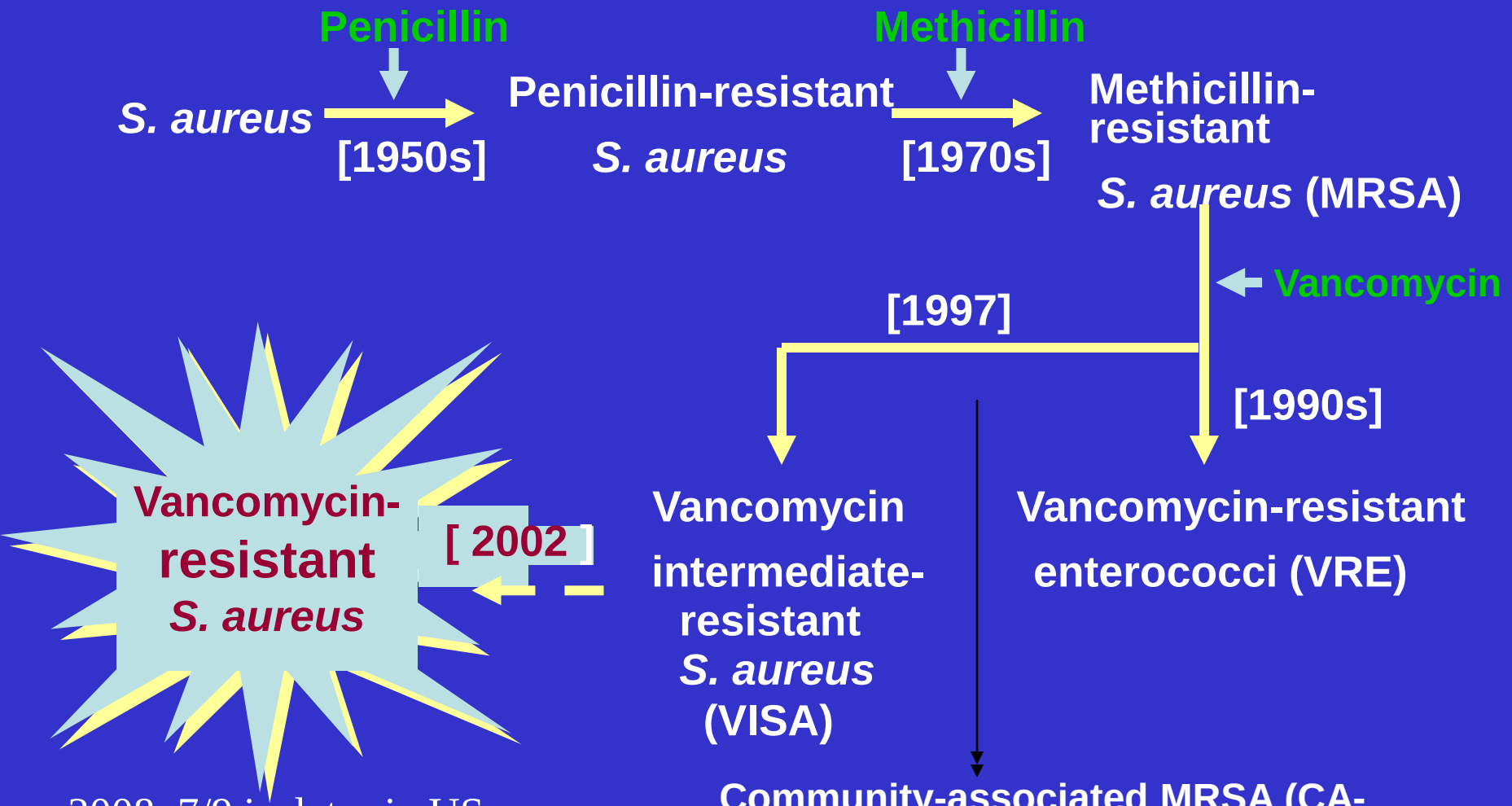
- *S. aureus:* gram-positive cocci, coag. positive
- Susceptibility testing:
  - Methicillin (oxacillin) resistance = strains produce penicillin binding protein 2a encoded by *mecA* gene; MIC against oxacillin ≥ 4μ/ml
  - *mecA* :mobile chromosomal element: staphylococcal cassette chromosome (SCCmec)
  - Dissolve beta lactam antibiotics, e.g. penicillins and cephalosporins
- Diagnostic methods:
  - Std. Culture or use chromogenic agar (24-72 hrs)
  - Molecular: PCR (2-5 hrs; but most labs need to run in batches); weakness - mixed culture, e.g. S. aureus & coagulase negative Staphylococci?





Murray PR, et al Manual Clin Micro.
Lowy FD, Freeman JD; Up-to-Date

Evolution of Drug Resistance in *S. aureus*



2008: 7/9 isolates in US are From patients in SE MI.

Next New Strain?

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A_____ ***S. aureus***

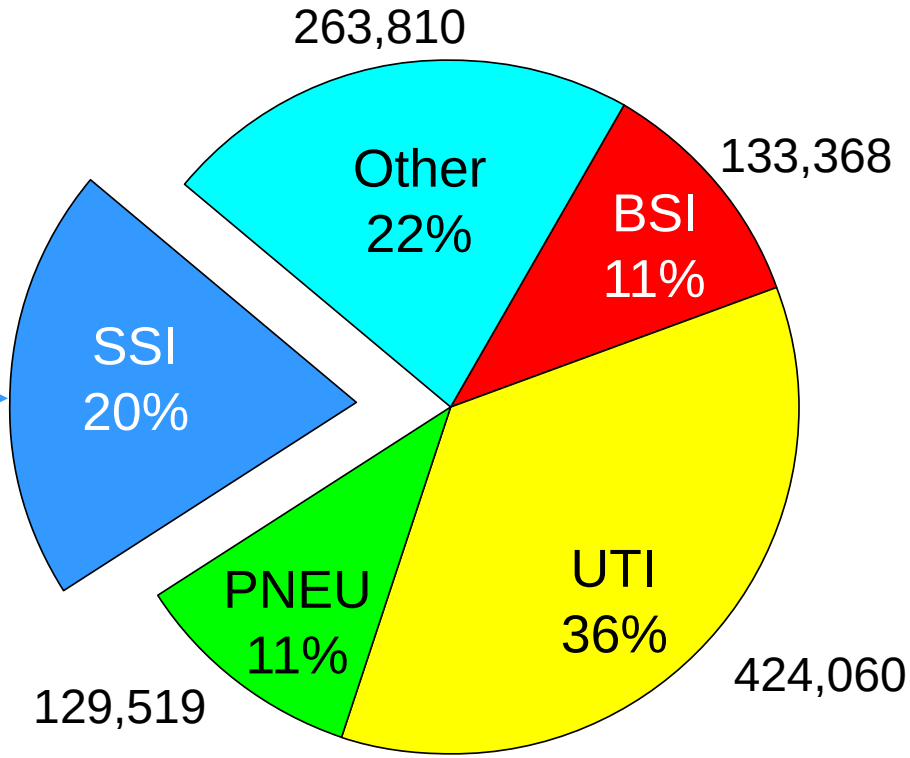
Prevalence of S. aureus colonization in the US: 2001-2002

- Nasal swabs
- ~10,000 non-institutionalized persons over age 12 months
- 32.4% colonized with S. aureus; extrapolated total for U.S = 89.4 million people
- 0.84% colonized with MRSA or for U.S. = 2.3 million people
  - Associated with age >60; female
  - Over 40 unique strains

Kuehnert MJ, et al National Health and Nutrition Examination Survey. J Infect Dis 2006;193:172-9.

How Big of a Problem are Health care-associated Infections (HAIs) in U.S. hospitals?
Total HAIs / year = 1.7 million; 98,987 deaths

274,098 TOTAL
-967 HRN
-21 WBN
-28,725 Non-newborn ICU
244,385 = SSI



HRN = high risk newborns
WBN -= well-baby nurseries
ICU = intensive care unit
SSI = surgical site infections
BSI – bloodstream infections
UTI = urinary infections
PNEU = pneumonia

Klevens, et al. *Pub Health Rep* 2007;122:160-6

Pathogens Causing CLABSI

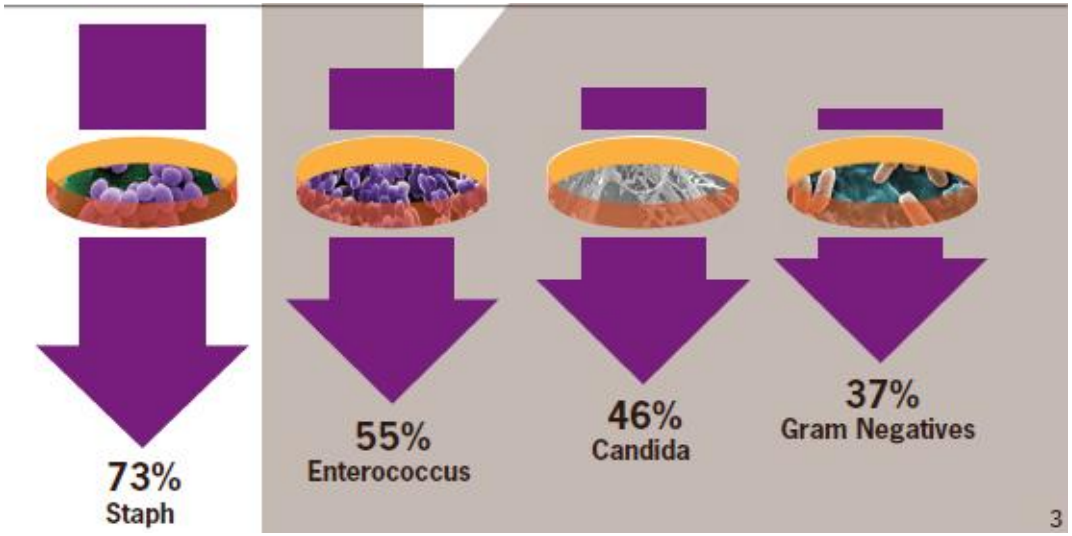
Rank Order, NHSN, CDC, 2006-07

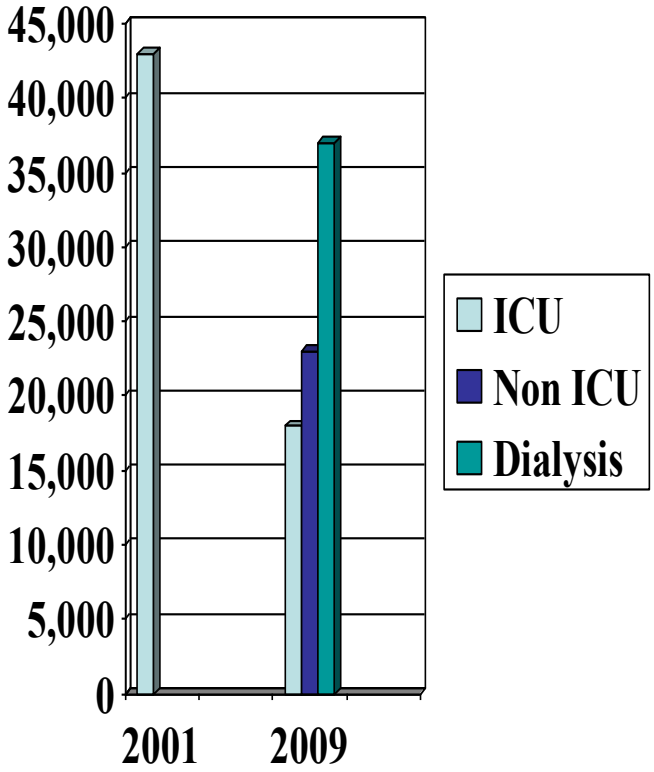
1. Coagulase negative *Staphylococci*
2. *Enterococcus spp*
3. *Candida spp.*
4. *S. aureus: 57 %* = MRSA
5. *K. pneumoniae*

Hidron AI, 2008

Trends in Incidence of CLABSI, U.S.,2001-2009

- 58% reduction in No. of cases in ICU [pooled mean, NHSN 3.64 (2001) vs 1.65 (2009)
- 27,000 lives saved
- CLABSI cost avoidance = $1.8 Billion





Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Weekly / Vol. 60 / No. 8
March 4, 2011

More Good News on MRSA

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- 9.4% decrease in invasive MRSA infections between 2005-08
- Most prominent for: BSIs (hospital-onset) and health care-assoc. community-onset infections

Table 3. Modeled Yearly Percent Change for All Invasive Methicillin-Resistant *Staphylococcus aureus* (MRSA) Infections and Bloodstream Infections, January 2005-December 2008

Epidemiological Category	Modeled Yearly Percent Change (95% Confidence Intervals), %[a]	*P* Value
All invasive MRSA infections		
Hospital-onset	−9.4 (−14.7 to −3.8)	.005
Health care–associated community-onset	−5.7 (−9.7 to −1.6)	.01
MRSA bloodstream infections		
Hospital-onset	−11.2 (−15.9 to −6.3)	.001
Health care–associated community-onset	−6.6 (−9.5 to −3.7)	<.001
Dialysis in last year	−6.4 (−11.4 to −1.1)[b]	.02
No dialysis in last year	−7.2 (−11.4 to −2.8)[b]	.006

[a] Multilevel model adjusted for age and race unless otherwise specified.
[b] Unadjusted multilevel model.

Health Care–Associated Invasive MRSA Infections, 2005-2008

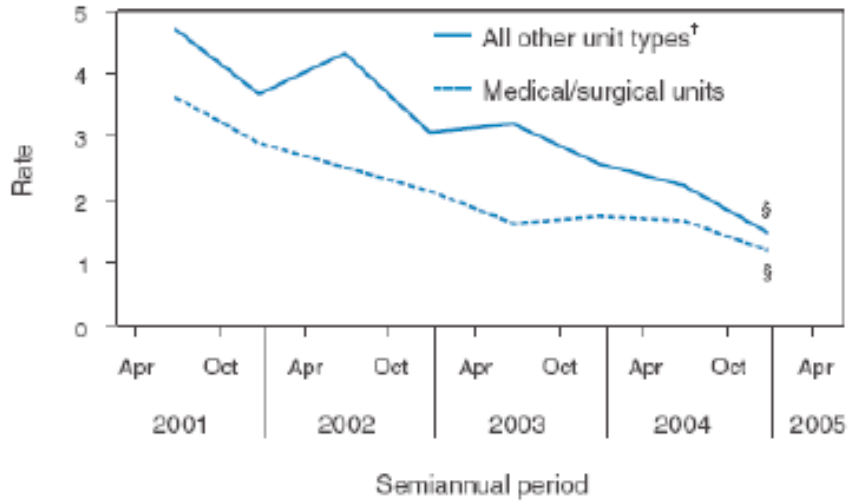
Kallen AJ, et al. JAMA; 304:641-8.

State of prevention Knowledge/Science

Successful Implementation of HICPAC/CDC Guidelines Prevents Bloodstream Infections

Pennsylvania

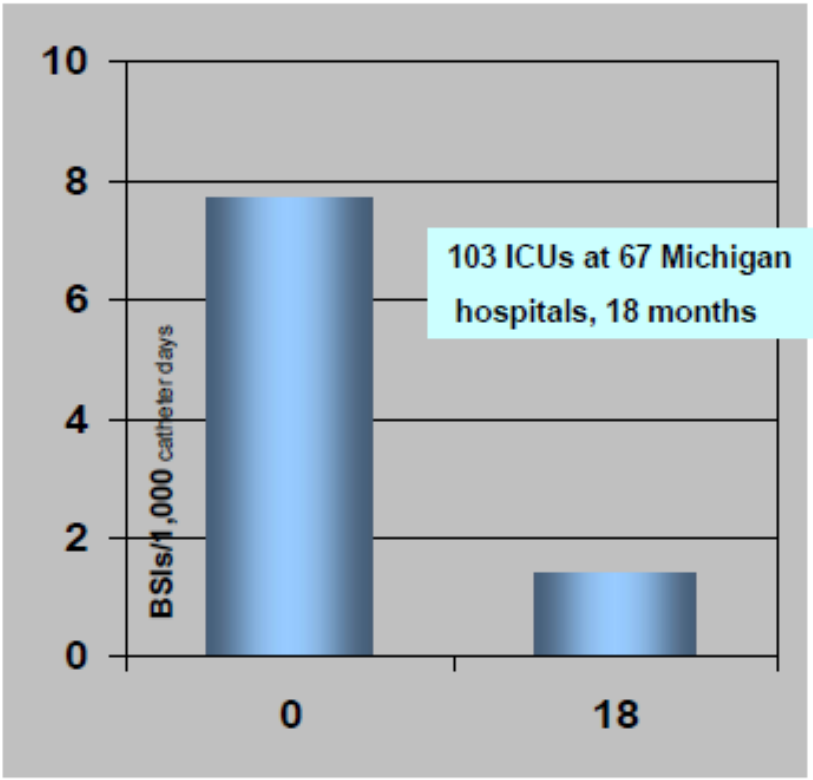
FIGURE. Central line–associated bloodstream infection rate* in 66 intensive care units (ICUs), by ICU type and semiannual period — southwestern Pennsylvania, April 2001–March 2005



* Pooled mean rate per 1,000 central line days.
† Includes cardiothoracic, coronary, surgical, neurosurgical, trauma, medical, burn, and pediatric ICUs.
§ p<0.001.

MMWR 2005;54:1013-16

Michigan



Pronovost P. New Engl J Med 2006;355:2725-32

MRSA in Michigan

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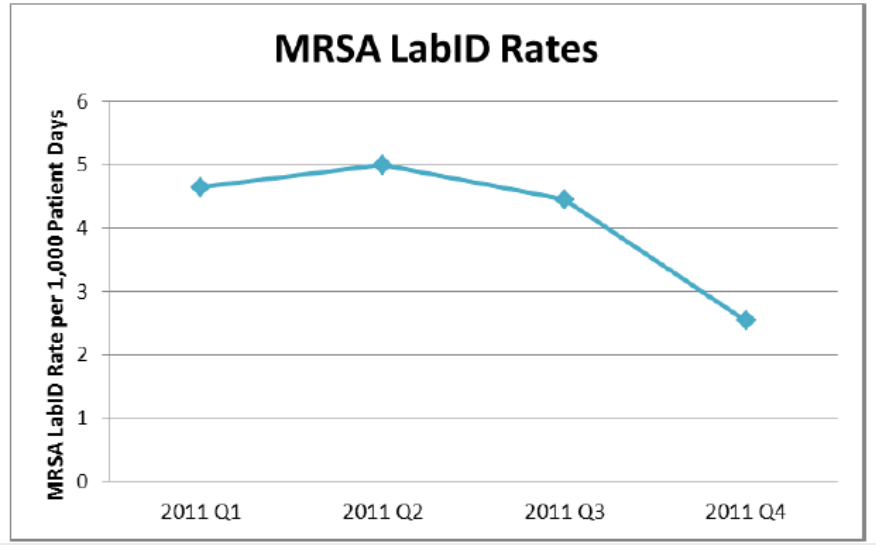
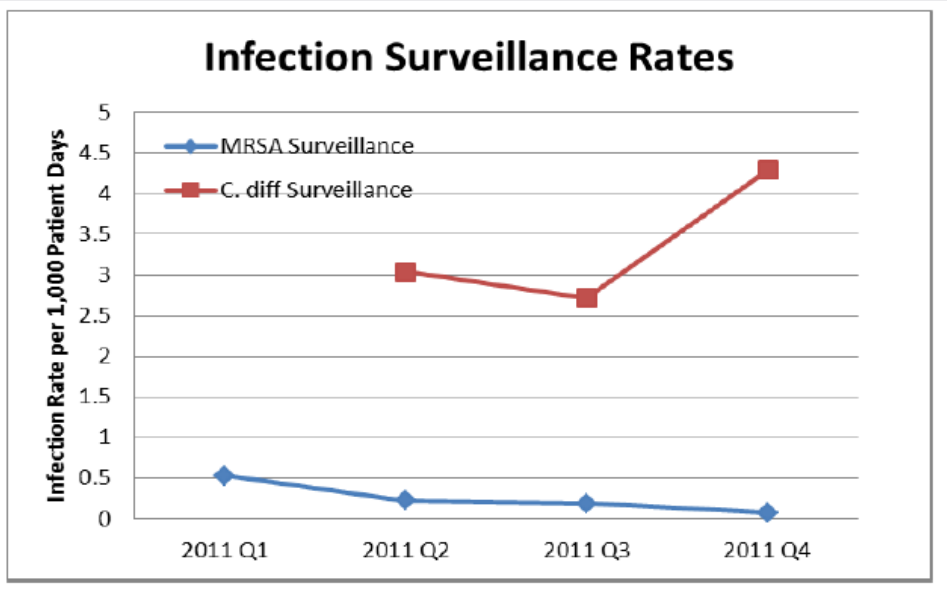


Quarterly HAI Report, SHARP Unit, 10/1 –12/31/2011



Michigan Department of Community Health
MDCH
Rick Snyder, Governor
Olga Dazzo, Director

Healthcare-associated Infections
HAI Elimination
www.michigan.gov/hai

Surveillance & Infectious Disease Epidemiology

Basic Principles…Are Important

Most MDROs are transmitted via hands of HCWs

Contaminated Surface

Susceptible Patient

Hands of the HCW

Non Compliance
Hand Hygiene

Kramer A
BMC Infect
Dis 2006;6:
130

Prevention Strategies: Hand Hygiene

WHO 5 Moments for Hand Hygiene

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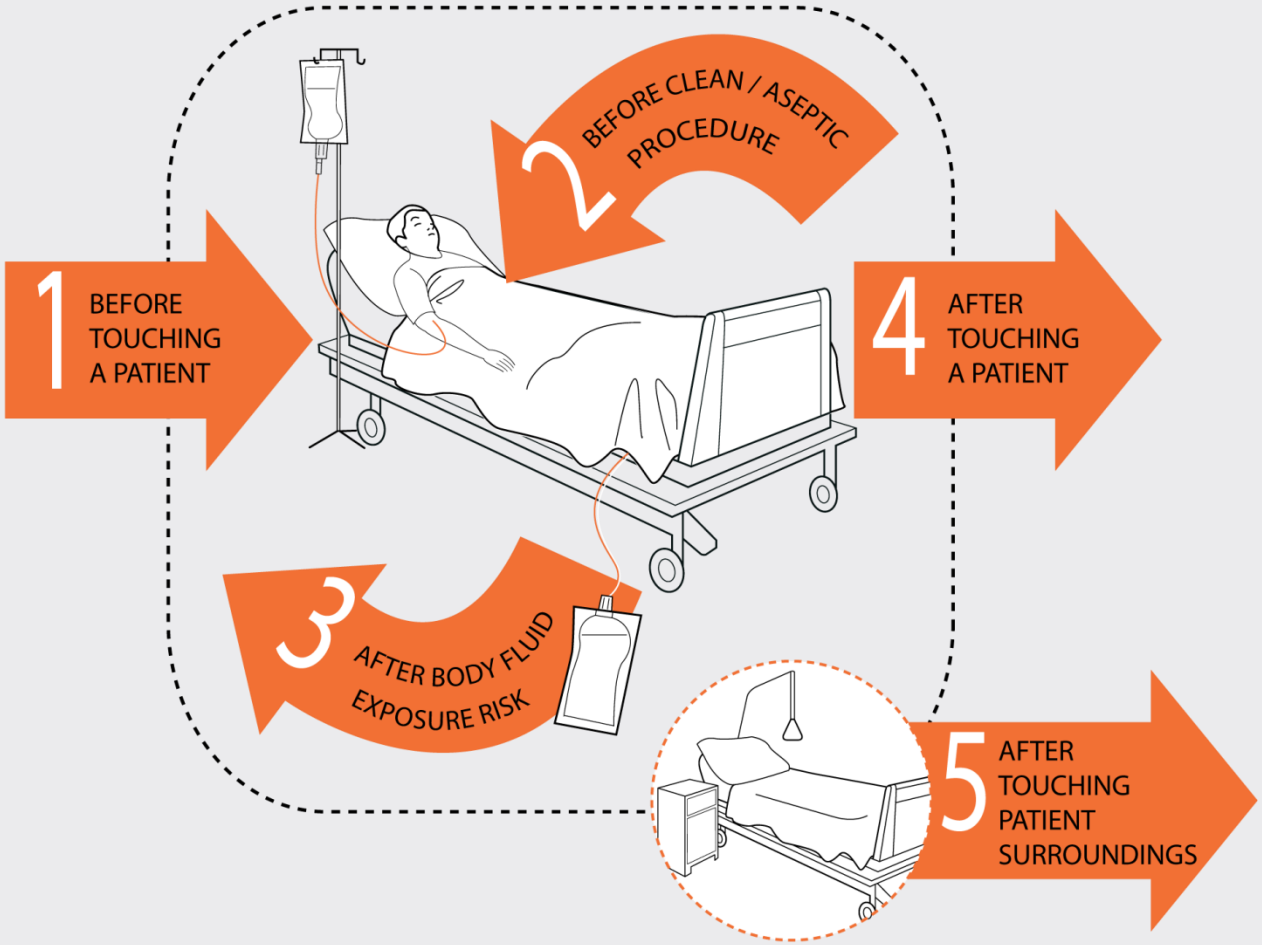

The Environment of Care:

"Honest Russ, I just touched the bed rail…"

100-1,000 bacteria transferred by

- Pulling patients up in bed
- Taking a blood pressure or pulse
- Touching a patient's hand
- Rolling patients over in bed
- Touching patient's gown or bed sheets
- Touching equipment like bedside rails, over-bed tables, IV pumps

Rounding Up Reservoirs of Microbes: Source control aka Patient Hygiene

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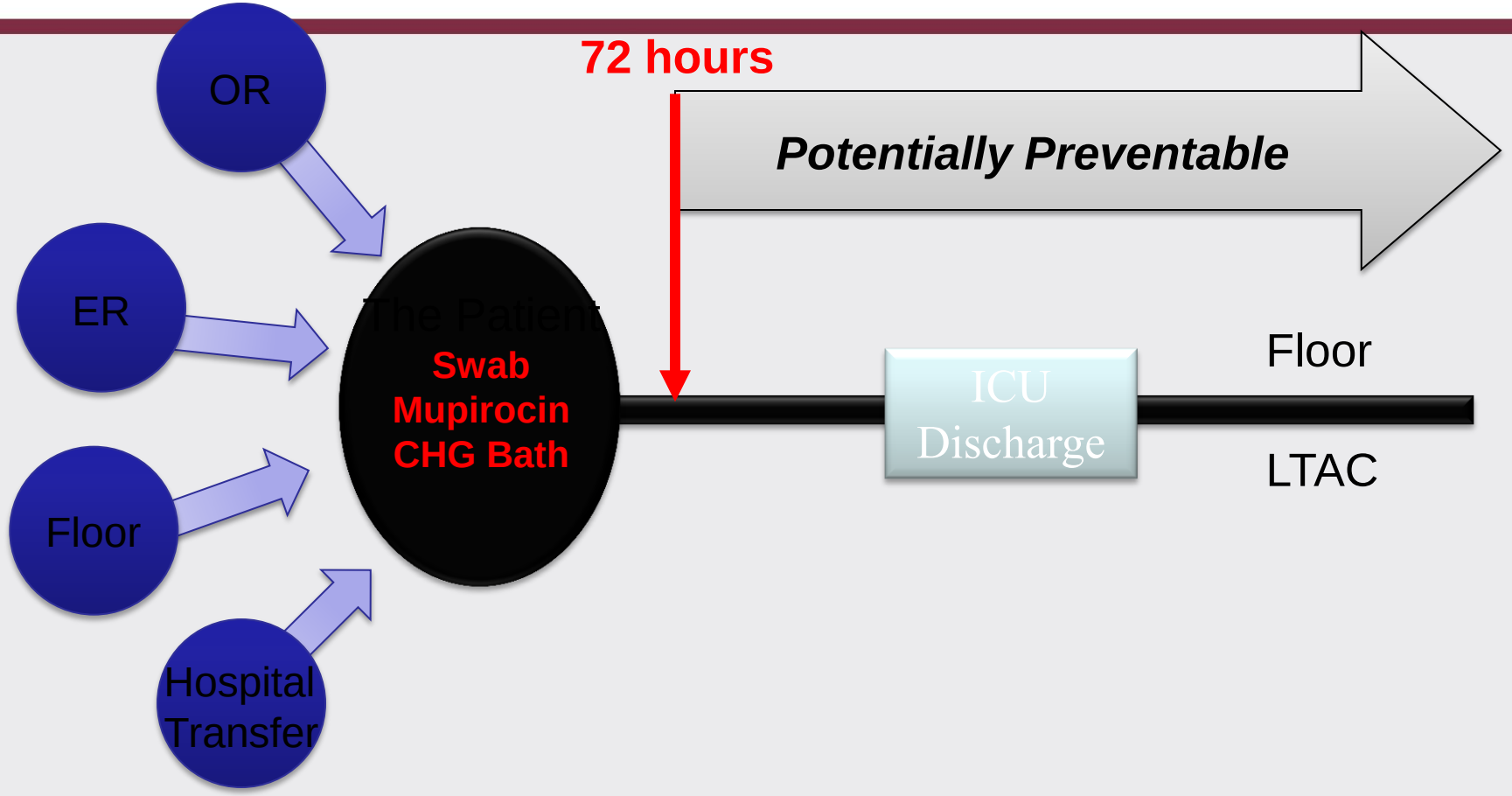


Foundation of Fundamentals

Hand Hygiene - Catheter Bundle - VAP Bundle - OR Best Practices - Judicious Antibiotics

ORIGINAL INVESTIGATION

Effectiveness of Chlorhexidine Bathing to Reduce Catheter-Associated Bloodstream Infections in Medical Intensive Care Unit Patients

Susan C. Bleasdale, MD; William E. Trick, MD; Ines M. Gonzalez, MD; Rosie D. Lyles, MD; Mary K. Hayden, MD; Robert A. Weinstein, MD

Patient Safety Using Hygiene

- 1 yr. cross over study in two MICUs, Stroger hospital, Chicago IL
  - Intervention: daily cleansing of patients with disposable cloth containing chlorhexidine gluconate (CHG)
  - Control group: daily cleansing with soap and water
- Results:
  - Intervention group:
    - 4.1 primary BSIs / 1,000 pt. days
    - 6.4 / 1,000 central line days
  - Control group:
    - 10.4/ 1,000 pt. Days
    - 16.8 / 1,000 central line days
- Conclusion: Incidence of BSI in CHG-cloth group was 61% lower than control (soap and water) group. Reduction of concentration of bacteria on skin lessens risk of BSI.

Bleasdale SC,et al. Arch Intern Med 2007;167:2073-9

Isolation Precautions + Prevention Resources:

MDCH HAI Pages

MI-MARR LTC Toolkit
www.mi-marr.org

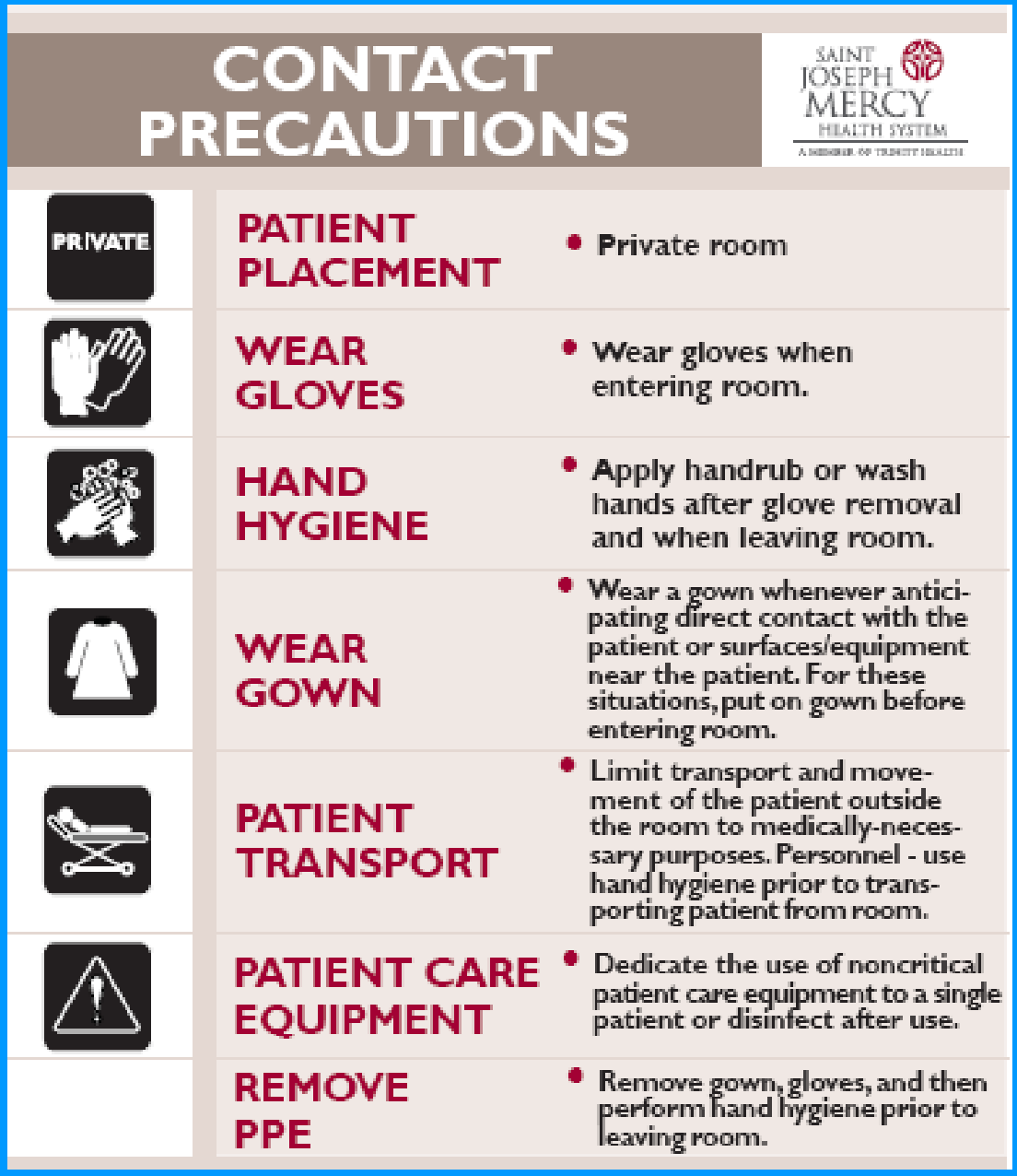
APIC MRSA Elimination Guide: LTC, 2009

SHEA Compendium, 2008

CDC Isolation Gdln, 2007

APIC MRSA Elimination Guide: Acute Care, 2007

CDC MDRO Gdln, 2006



The Inanimate Environment Can Facilitate Transmission

~ Contaminated surfaces increase cross-transmission ~

Duckro AN, et al. Transfer of VRE via HCW Hands. Arch Intern Med 2005

Renewed Respect for EOC:
Who's Been in the Room Before or With You?

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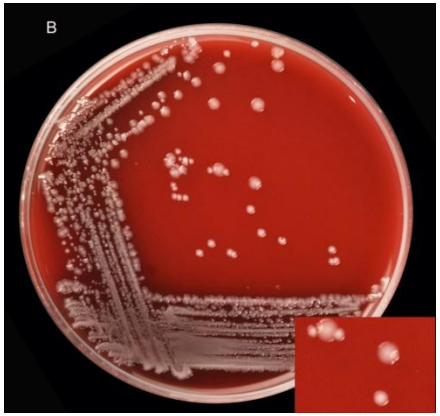
- Documented increased risk of acquisition of certain MDROs when admitted to a room if prior occupant had MDRO or in multibed room
  - Huang SS (2006)[1]
  - Drees M (2008)[2]
  - Zhou Q (2008)[3]
  - Moore C (2008)[4]
  - Hamel M (2010)[5]

Additional Prevention Strategies: Active Detection of MRSA Colonization: A Tale of Two Approaches

- Broader Aspects of ASC + Contact Precautions:
  - Do you have enough private rooms & personnel?
  - Do you actively monitor adherence with contact precautions (CP)?
  - Consequences of placing patients in contact precautions = less care and increased risk of other adverse effects; e.g falls/ med errors
  - Decolonization therapy?
  - Once positive for a MDRO does this mean isolation for all future possible readmissions forever?



Diekema DJ, Edmond MB. Clin Infect Dis 2007;44 (April 15)

STAR*ICU ClinicalTrial; Huskins WC, et al. Active Surveillance: CP vs Routine Care

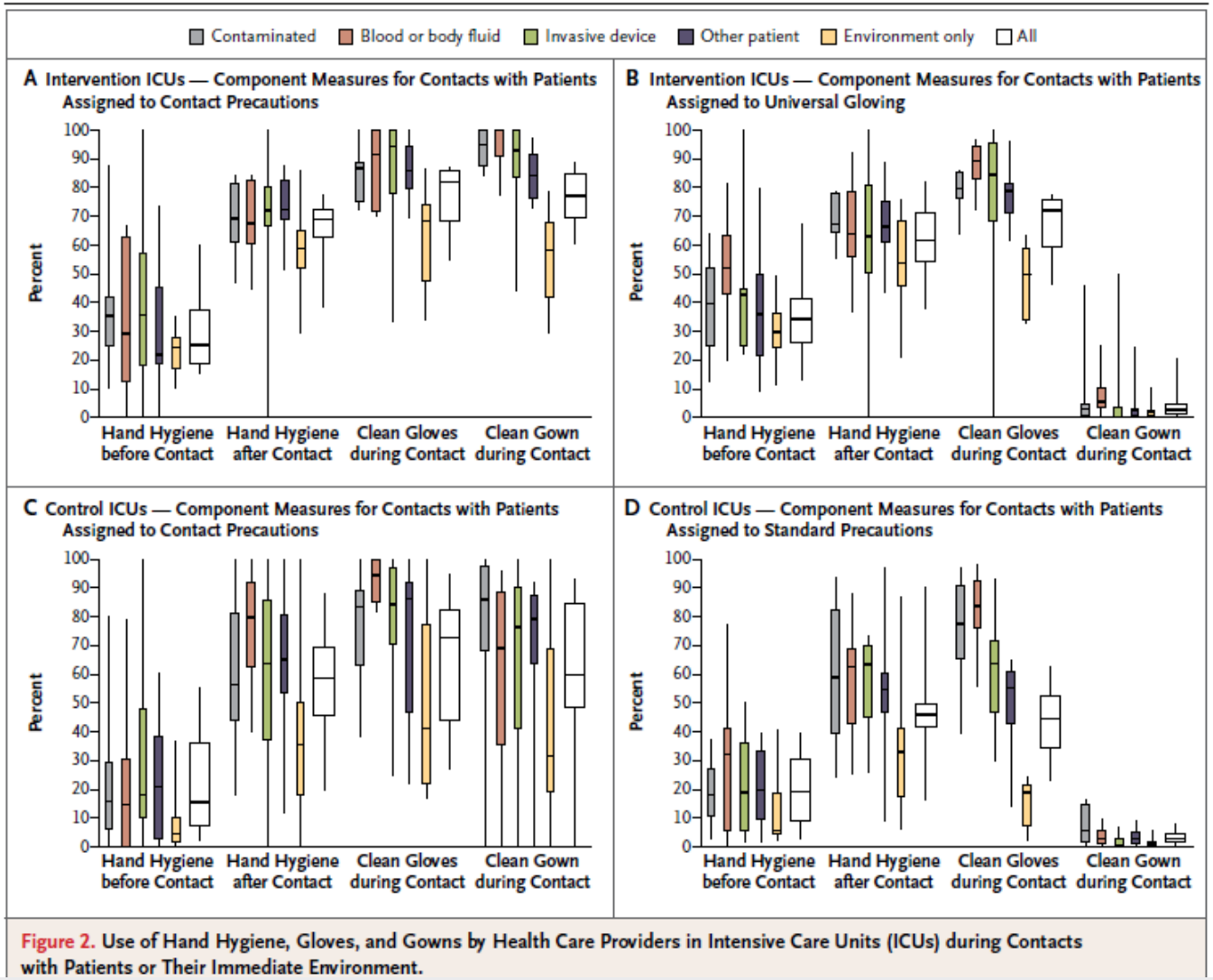


Figure 2. Use of Hand Hygiene, Gloves, and Gowns by Health Care Providers in Intensive Care Units (ICUs) during Contacts with Patients or Their Immediate Environment.

No difference in mean incidence of MRSA or VRE in intervention (AS+CP) vs control ICUs.

NEJM 2011; 364:1407-18

Veterans Affairs Initiative to Prevent Methicillin-Resistant *Staphylococcus aureus* Infections

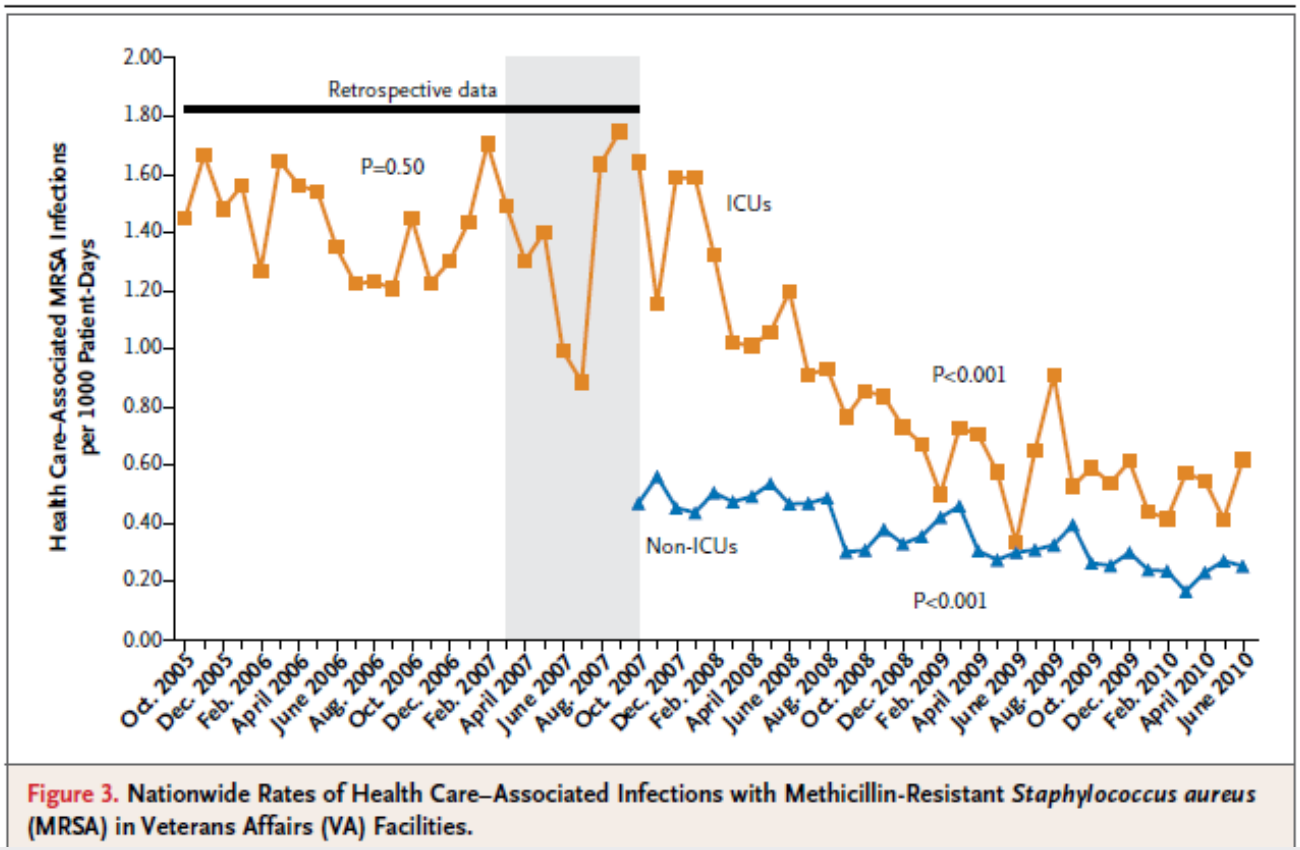


Figure 3. Nationwide Rates of Health Care–Associated Infections with Methicillin-Resistant *Staphylococcus aureus* (MRSA) in Veterans Affairs (VA) Facilities.

2007 MRSA bundle:

AS+CP, HH, culture of safety on infection prev./control – all VAMC/all patients.

Significant drop (62%) in HA-MRSA infs. after the MRSA Bundle in ICUs + signif. Reduction in non-ICU

Jain R, et al. NEJM 2011; 364:1419-30.

Antimicrobial Stewardship

National Center for Emerging and Zoonotic Infectious Diseases
Division of Healthcare Quality Promotion

Other Prevention Strategies

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- ✓ **Standard Precautions**
- ✓ **Intra-Facility Communication of detection of MDRO in the patient/resident – We're all in this together!**
- ✓ **Education & awareness**
- ✓ **<u>Supplemental measures</u>:**
  - **Active surveillance + pre-emptive contact precautions**
  - **Decolonization**
  - **Enhanced disinfection: whole area disinfection**
  - **Self-Disinfecting Surfaces**

[Russ's Take on the latter two: little scientific evidence, ready for prime time???? Probably not but say tuned….]